

CIGUATERA: RISK PERCEPTION AND FISH INGESTION

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A survey of 37 attendees at the Clinical Ciguatera session of the Ciguatera Management Workshop, Bribie Island, April 1993, completed a questionnaire to assess risk perception relative to fish ingestion among a group acutely aware of the ciguatera threat. The perceived risk difference between ingestion of fish personally purchased in the marketplace and fish served in a restaurant was assessed with responses from different groups (males/females, clinicians/biologists) within the sample being compared. No one would accept a risk of 10% in purchasing fish personally but one clinician would accept a risk of 20% in a seafood restaurant and 25% of respondents would accept a higher risk in a restaurant than in their purchasing unprepared fish.

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One of the most practical questions relating to human ciguatera poisoning is the question "What risk will I accept before eating a fish meal?". The answer to this question governs fishing policy, marketing regulations, species selection for gourmet dining and individual choice of menu.

Many factors influence the statistical risk of contracting ciguatera. Fish species, size of an individual fish, fish habitat (Lee, 1980), season of catch and size of portion all modify the intrinsic risk of developing ciguatera (Bagnis et al, 1979; Lawrence et al, 1980; Russell & Egan, 1991).

The statistical risk of contracting ciguatera varies with country and species (Hokama et al, 1993). The risk of contracting ciguatera on Niutao Island in Tuvalu is 1 in 10 (Dalzell, this memoir). In Micronesia, the risk of ciguatera from eating Moral eel viscera may be > 1 in 20. With Hawaiian jackfish (*Caranx* sp., or 'papio') the risk is 1 in 100 (Hokama et al, 1993). In Queensland, the risk of ciguatera is < 1 in 3,000 (Gillespie et al, 1986) and from a meal of coral trout (*Plectropomus maculata*) it is < 1 in 5,000.

Individuals modify their behaviour not on the basis of these objective figures, but on the perceived subjective risk (Pearn, 1973, 1977). Subjective risk is determined by such factors as sex (women usually being more conservative in the face of a gambling situation), personality (optimists being less conservative), past experience, concepts of probability and the perceived outcome including fatality (Pearn, 1973). In the specific risk of ciguatera following fish consumption, it is known that the objective risk of fatality is < 1 in 1,000 of clinical cases in Australian

(Tonge et al, 1967) and French Polynesian reports (Bagnis et al, 1979).

An objective risk of contracting ciguatera of < 1 in 1,000, with a risk of fatality of 1 in 1,000,000 for a random fish meal, is for many a low or trivial risk. On the other hand, many deny themselves the pleasures of gourmet fish meals because of the subjective (or perceived) risk which is seen to be more threatening than these low figures imply. We were interested to obtain data on this phenomenon of perceived or subjective risk in the context of human fish-consumption behaviour. Besides perceptions of subjective risk, risk-taking behaviour is known to be influenced by the social setting in which fish is consumed, and of course by peer influence. This has significant implications for consumption of risk species in seafood restaurants and in other social settings.

During a Workshop on Ciguatera Management a gathering of world experts on ciguatera participated in a risk-assessment study of professed personal decision-making in the face of a hypothetical ciguatera risk. We report here the results of this study of professed risk-taking behaviour in the context of a ciguatera threat.

METHODS

SUBJECTS

The subjects included all 37 individuals (31 males and 6 females) who attended the 'Clinical Ciguatera' Session of the International Workshop on Ciguatera Management, held at Bribie Island, Queensland, on 15th April 1993, under the auspices of the (Australian) Fisheries Research and Development Corporation and the

TABLE 1. Maximum acceptance risks for buying a marketplace fish which might be ciguatoxic. Thirty-seven world experts in ciguatera, at the International Ciguatera Management Conference, Queensland, Australia, 1993.

GROUP	RANGE OF MAXIMUM ACCEPTANCE RISKS	MEDIAN ACCEPTANCE RISK
All female subjects	0 - 10%	0.1%
All male subjects	0 - 10%	0.2%
Clinicians	0.01-10%	0.01%
Research scientists	0 - 10%	1.0%
All subjects	0 - 10%	0.1%

Queensland Department of Primary Industries. No subject refused to take part in this study. All were university graduates and (comprising as they did the world leaders in this subject) all were fully informed of the implications of ciguatera poisoning. Of the 37 subjects, nine were practising clinicians and 25 were biological research scientists working in this field. Subjects came from Australia, USA, France, Japan and the United Kingdom. All were proficient in English.

QUESTIONNAIRE

Each subject completed a personal questionnaire, anonymously, giving details of sex, discipline (research scientist, clinician etc) and professed acceptance risks in the instance of two separate question-scenarios. A brief (5 min) verbal exposition about the nature of the study was presented by one of us (JP) prior to the completion of the questionnaire.

Each subject was asked to respond to two specific questions:-

1. Imagine you are staying in a country where ciguatera occurs. You are buying fish in a shop or market, to take home for yourself or your family. What (maximum) level of risk of ciguatera would you accept, before buying the fish?

2. Imagine you are in a seafood restaurant, in a country where ciguatera occurs. Fish is served. It is a species known occasionally to be ciguatoxic. At what (maximum) risk level for ciguatera, would you eat the fish meal?

RISK SCALES

Subjects recorded their personal (subjective) acceptable risks in 3 ways: a) by a linear (Likert) scale marked from 0 to 100%, on which the subject draws a line at their personal risk acceptance level, b) by a vulgar fraction, and c) by a percentage figure. In each of these systems, a risk of '0' means that an individual will not accept any risk whatsoever. In the context of the specific questions we asked this implies that the in-

dividual would not eat a risk-species of fish under any circumstances. A risk of 100% or 1.0 implies that an individual would go ahead and consume fish even if it was certain that the subject would contract ciguatera from such ingestion. The specific risk of 50% (with the appellation '1 in 2' risk) was marked on the Likert scale.

RESULTS

Of the 37 subjects, all but one recorded their professed risk-acceptance levels in each of the 3 modalities. For Question 1, about acceptance risks for ciguatera when buying fish in the market place (Table 1), 7 subjects (19%) said they would not accept *any* risk, and would not buy risk species of fish for which there was any chance whatsoever of contracting ciguatera; 13 (35%) said they would accept a risk of 1% or greater, that is a risk of 1 in 100 or greater; 4 (3 research scientists and 1 male clinician) said they would accept a risk of 10% (1 in 10) of contracting ciguatera.

For question 2, concerning restaurant consumption of potentially toxic fish (Table 2), 8 subjects (22%) said they would not eat any fish species in a seafood restaurant, where there was any risk whatsoever of contracting ciguatera; 8 (22%) said they would accept risks of 10% (1 in 10) or higher. This widespread difference in professed behaviour, in the face of a medical risk, parallels the widespread attitude to risk seen in other medical situations (Pearn, 1973).

Analysing the individual responses to each of the two questions revealed that 21 subjects (58%) did not change their professed risk-acceptance level when confronted by the different social and peer pressures inherent in eating in a seafood restaurant. Nine subjects (25%) professed to accept higher risks in the seafood restaurant scenario, with a median increase in risk, in this group, by a factor of five. In the open-ended section of the questionnaire marked 'comments',

TABLE 2. Maximum acceptance risks for eating a potentially ciguatoxic fish meal in a seafood restaurant. Thirty-seven world experts on ciguatera, the International Ciguatera Management Conference, Queensland, Australia, 1993.

GROUP	RANGE OF MAXIMUM ACCEPTANCE RISKS	MEDIAN ACCEPTANCE RISKS
All female subjects	0 - 5%	0.2%
All male subjects	0.01 - 20%	0.1%
Clinicians	0.01 - 5%	0.1%
Research scientists	0 - 20%	0.1%
All subjects	0 - 20%	0.1%

6 wrote that they would accept higher potential risks in a seafood restaurant scenario, because of social and peer pressures, and because of such themes as 'being an honoured guest', or 'good manners in a group situation'.

DISCUSSION

This study shows that the majority of subjects, themselves expert in ciguatera, accepted risks for contracting the disease which were greater than the real life objective risks around the Pacific rim and in the Caribbean. No worker professed to accept a planned fish-buying risk greater than 10% (1 in 10), although 1 individual would be prepared to accept risks of 20% (1 in 5) of contracting ciguatera from eating in a seafood restaurant. It is the objective (mathematical) risk of ciguatera which concerns questions about fishing industry policy, species prohibition and the funding for management, monitoring and research. By contrast, subjective risk determines the choice of fish for personal and family consumption, menu selection and such diverse themes as legal and compensation issues. Decision-making in the face of a threat always involves a balance between perceived or subjective risk on the one hand, and the outcome (or utility) of a won gamble on the other. In the study reported here, the 'utility' - the joy of enjoying a gourmet fish meal together with the risk of escaping clinical ciguatera - this 'utility' is as consistent for a within-group pattern as it is possible to imagine. The collective 'utility' - good health after risk-fish ingestion, or its inverse, clinical ciguatera - was fully understood by all participants, all of whom were giving papers on the subject at an international conference.

Many subjects think of personal risk in quite specific and individual ways. Optimists tend to regard themselves as invulnerable and will take quite high (objective) risks. Pessimists on the

other hand and those with obsessive traits will reject risks and not enter a gambling situation where the risks are mathematically very low (e.g. <1 in 1,000 or even <1 in 10,000). Almost everyone behaves inconsistently in their life's behaviour when it comes to risks. Some will accept quite high risks in some areas of human activity (speeding in the car, for example; or driving after drinking) but will not accept very low risks in other areas. For example almost all home owners will not leave their home uninsured against fire, even though the objective risks are <1 in 60,000 and the outcome often not as severe as the consequences of a motor vehicle accident.

The relationship between ciguatera and public and commercial liability is a topical theme. There is an undoubted duty of care to reduce the risk of ciguatera to individual subjects. This applies both to legal liability in common law and to statutes in various Workplace Safety Acts and in Fair Trading Acts. The courts of various countries try to set what is a 'reasonable' or 'practicable' risk, with penalties potentially imposed on those who expose individuals to risks greater than these arbitrary levels. The current study reported here shows that experienced, informed ciguatera scientists and clinicians collectively take greater risks than are currently accepted as 'safe' in the fishing industry and in restaurant commerce. What the implications of this are, in the evolution of regulations and for case law, is for the future to determine. Certainly, the law always demands public health regulations and commercial 'duty of care' to be set at much safer levels (that is lower risks of exposure) than that pragmatically accepted by individuals functioning in their own personal lives. This research confirms this general observation in the specific context of ciguatera. Large individual differences exist in risk-taking behaviour generally (Pearn, 1973; Pearn, 1977), differences which are shown here to apply to ciguatera specifically.

Health regulations and case-law practice (the latter set by precedent) strive to protect all in society - not only those whose personal behaviour tends to be risky. In the developed world, the perspective of the fishing industry is thus to see a majority of informed individuals who will accept a risk of upto 1 in 1,000 (0.1%) of contracting ciguatera from dining in a seafood restaurant. Of the world's ciguatera experts 69% professed that they would be happy to accept such a risk under these circumstances. Whether or not this is 'risky' behaviour is also a subjective judgement. Current regulations and some legal opinion indicates that even those who profess to accept such risks must be protected. Health regulations and local custom (such as the banning from sale of the red bass, *Lutjanus bohar*) operate to ensure that the objective risk to diners is significantly less than the subjectively- acceptable risk level.

The phenomenon of subjective risk is culture-dependent. Many individuals and indeed many communities in the developing Pacific countries accept the risk of ciguatera as a fact of life. In some such communities individuals accept risks >1 in 10. Where to set public health risk acceptance levels is thus difficult. If one is too conservative, education and local community policies will tend to reduce the impact of a highly nutritious, high quality delicious food source with consequent greater dependence on tinned fish and tinned meat - the so-called dietary colonialism. In Western countries of the Caribbean and the Pacific rim, objective risk rates also vary from society to society.

The fact that a significant proportion (25%) of subjects recorded that they would, in a restaurant setting, accept a higher risk than their own personal food-buying 'baseline' risk, imposes special responsibilities and duties of care on commercial restaurateurs. This implies that the special vulnerability of patrons, a proportion of whom are caught against their will and feel that they have to take higher risks than they would in other circumstances, need special protection. At the very least, it implies that the objective mathematical risk of a random fish meal producing ciguatera should be reduced as much as possible, and suggests that restaurateurs should be aware

of the geographical source of risk-species which they serve.

Attitudes to subjective risk are never static. They change as scientific knowledge of ciguatera increases; and will change further as practical test systems for detecting individual ciguatoxic fish become available. When they do, risk-acceptance habits of the fish-eating public will change again, as new community baselines are set for the risk of ciguatera.

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